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ABSTRACT

Although smoking cessation techniques have been effective, few programs have long term results. To investigate the effectiveness of a tobacco dependence relapse prevention program, 123 adult smokers (51 male, 72 female) voluntarily participated in one of four small group treatment conditions (6 or 30 second aversive smoking plus skill training, or 6 or 30 second aversive smoking plus discussion control) over a 14-week period. Skill training focused on relaxation, commitment enhancement, and relapse prevention skills, while discussion control focused on group discussions of habit breaking and desire for change. Prior to treatment and at 3, 6, 26, and 52 weeks post-treatment, subjects reported the number of cigarettes smoked in the past 24 hours, provided blood and air samples, and completed an assessment battery focusing on mood, anxiety, cost/benefits, withdrawal symptoms, behavior, and expectations. An analysis of the results showed that differences in abstinence rates and in number of cigarettes smoked favored the skill training condition at 6 and 52 weeks post-treatment. Exploratory analyses indicated that at 52 weeks lighter smokers (20 cigarettes per day or fewer at pretreatment) were more likely than heavier smokers to be favorably affected by the skill training condition. Subjects assigned to the skill training condition were more likely to report use of coping skills, but did not differ from the discussion condition in perceived costs and benefits of change or of smoking, or in mood dysphoria or physical complaints. Abstinent subjects reported less mood disturbance than nonabstinent subjects at weeks 3, 6, and 26, and fewer physical complaints at week 52. (Author/BL)

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PREVENTING RELAPSE TO CIGARETTE SMOKING BY
BEHAVIORAL SKILL TRAINING

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ABSTRACT

Two relapse prevention conditions (skill training vs. discussion control) were crossed with two levels of aversive smoking (6 vs. 30 second inhalations). One hundred thirty-five subjects were recruited. One hundred twenty-three subjects completed treatment. Differences in abstinence rates and in number of cigarettes smoked favoring the skill training condition were found at 6 and 52 weeks from study start. Exploratory analyses indicated that at 52 weeks lighter smokers (20 cigarettes per day or fewer at pretreatment) were more likely to be favorably affected by the skill training condition than heavier smokers. Subjects assigned to the skill training condition were more likely to report use of coping skills, but did not differ from the discussion condition in perceived costs and benefits of change or of smoking, or in mood dysphoria or physical complaints. Abstinent subjects reported less mood disturbance than nonabstinent subjects at weeks 3, 6, and 26, and fewer physical complaints at week 52. The relation of these findings to a model of maintenance of therapeutic change is discussed.

PREVENTING RELAPSE TO CIGARETTES BY BEHAVIORAL SKILL TRAINING

The smoking treatment literature describes effective cessation techniques (Lichtenstein and Danaher, 1976). Some techniques, most notably rapid smoking (Danaher, 1977; Hall, Sachs and Hall, 1978; Schmal, Lichtenstein and Harris, 1972) yield good cessation rates, sometimes as high as 90%. Yet, almost all treatments result in high relapse rates at long-term follow-ups. Workers in the field have repeatedly noted the need for models of relapse and techniques to prevent it. (Danaher, 1977; Hunt, Barnett and Branch, 1971; Lichtenstein and Danaher, 1976).

In a retrospective survey, Marlatt (Marlatt, 1978; Marlatt and Gordon, 1980) identified relapse situations common to alcohol, heroin, and tobacco dependence. The most common situations involved negative affect and direct and indirect social influences to use the drug. Shiffman (1982) studied exsmokers who called a relapse counseling hot-line. He found that over 70% of relapse crises were associated with negative affect. In nearly one-third of the crises, smoking stimuli were present. However, ex-smokers' coping responses, rather than the situation, distinguished those crises in which smokers relapsed from those where they did not. Exsmokers who performed any coping response were less likely to relapse than those who did not.

Most relapse prevention programs studied have been based on general social learning theory models (Chapman, Smith and Layden, 1971; Danaher, 1977; Delahunt and Curran, 1976; Lando, 1977, 1978; Lando and McCullough, 1978; Sutherland, Amit, Golden and Roseberger, 1975). None has evaluated a program based on a model specific to tobacco dependence, or even to relapse. The relapse prevention program we evaluated was based on a working model which emphasizes the interacting role of coping strategies and commitment in

maintaining change in addictive disorders (Hall, 1980). The model includes both behavioral and cognitive components. It suggests that (1) both knowledge and performance of relapse prevention strategies are needed to maintain change; (2) continued commitment is needed to motivate performance of coping skills, and, (3) commitment is a function of perceived costs and benefits of the problem behavior and change attempts. The model further suggests that factors influencing cost/benefit perceptions include the severity of withdrawal symptoms, feedback about the intermediate effects of change attempts, and difficulties involved in performing change strategies. It supports use of targeted, as compared to multifocal "shotgun" treatment approaches. It assumes increased cost if the subject invests time and energy in strategies that do not work.

In applying the model to the prevention of smoking relapse, we assumed coping skills must address both withdrawal symptoms and situational factors related to relapse. To address the former, the treatment program included cognitive relaxation training to decrease the anxiety and irritability often experienced during smoking cessation. To address the latter, the program included skill training for high risk situations. In both instances techniques were individualized. Thus, subjects did not devote a great deal of energy to techniques that did not work for them. To facilitate continued commitment, the program also included written exercises and physiological feedback to increase the perceived costs of smoking, and to emphasize the benefits of change.

Outcomes from previous studies of relapse prevention in smoking cessation have been mixed. Chapman, et al., (1971), Delahunt and Curran (1976), and Lando (1977), Lando and McCullough (1978), and Sutherland, et al. (1975), all reported that relapse prevention programs facilitated long-term abstinence rates. Less promising results were reported by Danahey (1977) and Lando (1978). However, favorable reports of treatment outcome did

not include controls for nonspecific factors, including time in treatment, attention, and credibility. Only Danaher (1977) controlled adequately for these factors, and he did not find a relapse prevention effect. Thus, there is little evidence for a relapse prevention effect above that produced by nonspecific factors alone. The present study included controls for such factors.

A secondary focus in this research was to compare two aversive smoking programs designed to be less stressful physiologically than rapid smoking as the latter is traditionally used. In "traditional" rapid smoking, smokers puff and inhale until they can no longer continue. Rather than smoking until they could no longer continue, subjects smoked a maximum of 3 cigarettes per session at either a 6 or a 30 second pace. Thus, both were less stressful than traditional rapid smoking. We assumed the 30 second pace differed little from the pace of normal smoking (Danaher, 1977), and thus provided minimal physiological stress. Videotape feedback of selected segments of the session was used to enhance the aversion. It also provided smokers with an image to use when tempted to smoke.

Subjects were assigned to one of four conditions in a 2 x 2 factorial design. These conditions were: 6 second aversive smoking plus relapse prevention skill training, 30 second aversive smoking plus relapse prevention skill training, 6 second aversive smoking plus discussion control, and 30 second aversive smoking plus discussion control.

We hypothesized that: (1) At weeks 6 (post booster sessions), 26, and 52, subjects treated with the relapse prevention program would show significantly greater abstinence rates and smoking reduction than discussion controls; (2) immediately following cessation treatment (week 3), 6 second aversion subjects would have higher abstinence rates and greater reduction in amount smoked than 30 second aversion subjects; (3) the relapse prevention skill training

program would produce greater increases in coping skills used and in commitment to nonsmoking, the latter as measured by perceived costs and benefits of smoking and perceived costs and benefits of change; (4) regardless of cessation treatment condition, the relapse prevention skill training program would produce greater decreases in anxiety and irritability.

METHOD

Subjects

Subjects were 135¹ smokers who contacted the program in response to public service announcements, newspaper stories describing the study, and physician and word of mouth referrals. All subjects: (1) attended an initial orientation meeting; (2) provided written informed consent; (3) were free of cardiovascular and pulmonary disease and were not pregnant; (4) provided a \$75 deposit returned contingent on attendance at assessments at weeks 3, 6, 26, and 52; (5) obtained their physician's permission to participate in the research. Subjects were assigned to 5-6 member groups in order of entrance into treatment, within their time constraints. Treatment for each small group was randomly selected with the constraint that each cohort have one group of each condition. Six cohorts were treated.

Leaders

Group leaders were (1) a female Caucasian graduate student in Health Psychology, who had no experience in behavior therapy or smoking treatment, and (2) a female Black graduate student in Clinical Psychology, who had extensive behavior therapy and group therapy experience, but no prior experience in smoking treatment. Assignment of leaders to groups was random with the constraint that each leader treat an equal number of groups in each condition.

Measures

Before study start, and at assessments at weeks 3 (posttreatment), 6 (post follow-up sessions), 26 and 52 subjects reported number of cigarettes smoked in the past 24 hours, provided blood and expired air samples for biochemical analyses. Subjects also completed an assessment battery.

Instruments included:

- (1) The Profile of Mood States (POMS: McNair, Lorr and Droppleman, 1971).

This 65 item self-report inventory has six Likert scales: Anger, Tension, Depression, Confusion, Vigor and Fatigue. Reported internal consistency coefficients for the six scales range from .92 to .84. The POMS has been widely used as a measure of change due to outpatient psychotherapy, drug administration and in studies of emotion-inducing conditions (McNair, et al., 1971).

- (2) State-Trait Anxiety Inventory (STAI: Spielberger, Gorsuch and Lushene, (1970)). This inventory is made up of 2 scales. Each scale consists of 20 items. The STAI A-State scales asks the subject to indicate how he or she generally feels. The A-State scale asks the subject to indicate feelings at any particular moment. Internal consistency coefficients for both the two scales are similar. They range from .83 to .92. The scale has shown validity as a measure of stressful situations and as a measure of the results of psychological interventions designed to reduce anxiety.

- (3) Costs and Benefits of Smoking and Costs and Benefits of Change.

The 25 item Costs and Benefits of Smoking Scale and the 10 item Costs and Benefits of Change Scale were based upon a longer scale developed by Hildebrandt and Feldman (1975). The original scale has concurrent validity: nonsmokers were found to be less favorable towards smoking than smokers and smokers less favorable towards smoking after treatment than before. In our sample, for the Costs and Benefits of Smoking Scale, Cronbach's alpha=.827. For the Costs and Benefits of Change, alpha=.622.

(4) Physical Withdrawal Symptoms. This 14 item scale was a modification of that prepared by Bachman (note 1) from symptoms described by smokers as experienced during quitting attempts. The scale has three factor based subscales: {a} flu-like symptoms (for example, headache, feeling low); {b} generalized craving (desire to smoke, thinking about smoking, desire to eat) and {c} opioid-like withdrawal symptoms (sweating, diarrhea). Cronbach's alpha for the total scale was .779.

(5) The Behavior Checklist. Subjects indicated on this 7 item scale whether they had performed a specific relapse prevention behavior during the previous week. Behaviors measured were: (1) use of formal relaxation skills; (2) use of other forms of relaxation; (3) removal of social pressure to smoke by assertion; (4) removal of social pressure to smoke in some other way; (5) use of image of self smoking; (6) reading materials about smoking; (7) other. Total number of behaviors used was the total score.

(6) Treatment Expectancy Questionnaire. At the end of the first treatment session, subjects rated on two 4 point scales the perceived efficacy of the treatment to which they had been assigned for (a) themselves, and (b) for smokers in general.

Procedure

Entrance into treatment was initiated by a telephone call. During this call, subjects were told the health, age, and deposit requirements of the study, and were given a brief description of the components of the treatment conditions. Those expressing interest were invited to an orientation meeting, at which treatment components and attendance requirements were explained. Subjects completed brief health histories, and were given informed consent forms and physicians clearance letters. When subjects had returned both the deposit and the physicians' clearance letter, they were assigned to treatment groups.

Before the first session, subjects completed the psychometric assessment battery, provided blood and urine specimens for biochemical analyses, and were weighed. A description of treatment they would receive was presented to subjects in a 5-10 minute summary at the beginning of the first treatment session. Following this presentation, subjects participated in the first aversive smoking session.

Smoking Cessation Conditions: 6 vs. 30 second Aversive Smoking

Eight of the 14 treatment sessions used aversive smoking. Four aversive smoking sessions were held during week one. Two were held during each of weeks two and three. In these sessions, subjects puffed and inhaled in their usual fashion on three consecutive cigarettes of their usual brand. Depending on condition, this rate was either every 6 or every 30 seconds. While subjects were smoking, the therapist encouraged them to direct their attention to the smoking experience, especially the negative aspects of it. Throughout the session, the therapist pointed out the negative aspects of smoking, for example, burning eyes, nausea, tingling hands and feet. This part of the session was videotaped. Following completion of the aversive smoking, subjects discussed their feelings while smoking. These feelings were generally negative, although occasionally subjects would report enjoyment of the first cigarette of the three. The therapist acknowledged this enjoyment, but always refocused the subjects' attention on the negative aspects. The videotape was then replayed. The therapist selected segments where group members appeared uncomfortable. Subjects were asked to visualize the replayed image and to reinstate it when they felt the urge to smoke. Subjects were instructed not to smoke outside the sessions.

Relapse Prevention: Skills Training vs. Discussion

Six of the sessions were relapse prevention sessions. One relapse prevention session was held during each of weeks 1, 2, 4, and 6. Two sessions

were held during week 3.

Skill Training

The skill training treatment had three components. These were (1) cue-produced relaxation training; (2) commitment enhancement by reviews of the costs of smoking and the benefits of nonsmoking; (3) relapse prevention skill training. The three components of the treatment were interspersed throughout the skill training sessions.

In cue-produced relaxation training, subjects were taught an adaptation of Benson's cognitive relaxation (Benson, 1975). Relaxation was presented as a way of coping with the anger and anxiety that often precipitate relapse. In using relaxation, subjects concentrated on their breathing, and on a cue word repeated with each exhalation. Subjects were then taught to pair a cue word, usually "calm", with feelings of relaxation, and to use the cue word to reinstate relaxation. Subjects were also encouraged to practice relaxing at home in a 15 minute session at least once per day. Subjects were strongly encouraged to make a commitment to the group to use either our method, or one they found more acceptable. Alternate relaxation responses mentioned by subjects included taking a walk, leaving the situation, and deep breathing. Approximately one and a half treatment sessions were primarily devoted to relaxation.

Commitment enhancement included feedback of expired air carbon monoxide levels, and information about the monetary, social, and health costs of smoking. The leader encouraged discussions of positive physical changes noted by subjects following smoking cessation. Each session included a brief commitment enhancement exercise.

Approximately three and one-half relapse prevention sessions were devoted primarily to skill training. The therapist reviewed lists of commonly experienced

relapse situations. Subjects identified those which had been difficult for them, or in which they anticipated difficulty. Under the leader's direction, they role played alternate responses or rethought the ways the situation might be perceived. If group members could not produce an effective alternate response to a high risk situation, the leader modeled an appropriate response. The skill training technique is described in detail elsewhere (Tunstall, Hall, Ginsberg, and Rugg, Note 2).

Discussion

The first four relapse prevention sessions in this condition began with completion of one of the four tests from The Smokers Self-Test Kit (Horn, 1972). These tests are designed for self-scoring and group discussion. Respectively, they focus on (1) "How badly do you want to change your smoking habits?" (2) "What do you think the effects of smoking are?" (3) "Why do you smoke?" and (4) "Does the world around you make it easier or harder to change your smoking habit?" The leader allowed the discussion to range from these topics, with the two constraints: that it remain focused on smoking, and discussions of specific skills were discouraged. The leader did not suggest specific techniques. If subjects did present skill plans, or requested them, the leader commented that different things worked for different people, and that individuals in the group should do what they considered best for them. The final two sessions had no specific topics for discussion, and were generally continuations of discussions occurring in the previous four sessions.

Results

Attrition

Attrition did not differ between the four treatment conditions, whether they were considered individually or collapsed by smoking and relapse prevention condition. Number of drop-outs were 4, 4, 3, and 1 respectively for 6 second/

skills, 30 second/skills, 6 second/discussion and 30 second/discussion respectively. Treatment conditions with and without drop-outs were compared on age, sex, socioeconomic status, ethnicity, number of cigarettes reported smoked at pretreatment, years smoked, and pretreatment cotinine levels.² There were no differences between groups on these variables. Means and standard deviations for treatment completers by group and for all conditions combined for smoking history are shown in Table 1. Demographic characteristics are shown in Table 2.

Insert Tables 1 and 2 About Here

Treatment Expectations

Expectations of treatment efficacy for self or smokers in general did not differ between conditions, whether each of the four treatments was considered individually, or if they were collapsed across smoking and relapse prevention conditions.

Verification of Self-Report

At 3 and 6 weeks, smoking status was verified by expired air carbon monoxide measured by the Ecolyzer (Hughes, Frederiksen and Frazler, 1978). At 26 and 52 weeks, a subject was considered abstinent if four measures indicated abstinence: self-report, significant other report, expired air carbon monoxide, and thiocyanate levels. (Since thiocyanate is sensitive to smoking within the past 10-15 days, subjects coded as abstinent can be considered non-smokers for at least 7 days.) Thiocyanate levels were obtained from blood plasma. They were analyzed by an automated Gas Liquid Chromatographic (GLC) method. This method has the sensitivity and precision of traditional methods, but allows for rapid analysis of large number of samples (Jacobs, Benowitz, Hall, Jones, Baker, and Yu, reference note 3). Cut-offs for carbon monoxide was 10 ppm; for plasma thiocyanate the cut-off was 85 ng/mg.³

Therapist and Cohort Effects

Therapist and cohort main and interactions were tested by χ^2 tests and hierarchical logistic regression (Hosmer, 1980). There were no significant therapist main effects on outcome, or interactions at any assessment period. Main effects for cohort approached significance at week 3 ($\chi^2(2)=10.797$, $p < .06$) and week 52 ($\chi^2(2)=9.605$, $p < .09$). However, this did not reflect a linear trend due to time, and cohort X treatment interactions were not significant. Therefore, data were combined over therapists and cohorts.

Treatment Outcome

Hypothesized differences between conditions were tested by Chi-Square tests (one-tailed; computed according to Camilli and Hopkin, 1978) on abstinence rates and by hierarchical multiple regression on number of cigarettes smoked. All drop-outs left treatment before completing one relapse prevention session. Therefore, the effects of the relapse prevention condition are most appropriately tested with these subjects removed from the data since the drop-outs received none of the treatment.

When compared to the discussion condition, the skill training condition produced greater abstinence at all assessments but week 3. These differences were significant at week 6 ($\chi^2(1)=3.07$, $p < .04$) and 52 ($\chi^2(1)=3.06$, $p < .04$) but not at week 26 ($\chi^2(1)=2.23$, $p < .06$). Differences between relapse prevention conditions were not hypothesized at week 3, and none were found ($\chi^2 < 1$).

Abstinence rates for skills and discussion conditions, respectively were: week 3, 89 and 91%; week 6, 81 and 67%; week 26, 54 and 41%, and week 52, 46 and 30%.

No differences were found between 6 and 30 second smoking conditions at any assessment ($\chi^2 < 1$, all tests).

Number and percent abstinent for each condition at each assessment period are shown in Table 3.

Insert Table 3 About Here

Significant differences in self-reported number of cigarettes smoked as a function of relapse prevention condition were also found at weeks 6 and 52. Main effects for relapse prevention condition were significant at week 6 ($F(1,119)=7.559$, $p < .01$), but missed traditional levels of significance at week 26 ($F(1,119)=2.628$, $p < .10$). At 52 weeks, a significant covariate X relapse prevention condition interaction was found ($F(1,119)=8.777$, $p < .004$). Cigarettes smoked and percent reduction by condition for all subjects are shown in Table 4. These interactions were analyzed according to the methods of Cohen and Cohen (1975) for quantitative x nominal interactions. Regression equations predicting number of cigarettes smoked at week 52 by number of cigarettes smoked at pretreatment were computed separately for skill and discussion subjects. For skill subjects, $r^2=.485$, $B=.634$, $F(1,46)=43.36$, $p < .0001$. For discussion subjects, $r^2=.192$, $B=.394$, $F(1,56)=13.35$, $p < .0006$.

Insert Table 4 About Here

Inspection of the raw data indicated this interaction could best be understood by an analysis of reduction as a function of pretreatment smoking. Subjects in the two relapse prevention conditions were divided into categories by number of cigarettes smoked per day at pretreatment (20 or less, 21-30, more than 30), and by percent reduction at week 52 (100%, 99-50%, less than 50%). Three χ^2 tests were computed, one at each of the three levels of pretreatment smoking. The dependent variable in each was number of subjects in each percent reduction category. Independent variable was relapse prevention condition. Significant differences were found for subjects smoking 20 cigarettes or less per day at pretreatment ($\chi^2(2)=5.829$,

(two-tailed) $p < .05$, $N=51$). Percentages of subjects reducing 100%, 99-50% and less than 50% were 65.2, 13.0, and 21.7 for skill subjects and 32.0, 17.3, and 50.2 for discussion. For subjects smoking either 21-30 or more than 30 cigarettes per day, differences between relapse prevention conditions were not significant $\{(X^2(2)=3.983, p .14, N=30, X^2(2)=1.365, p .51, N=42)\}$.^{4, 5}

The results for nonabstainers paralleled those for the entire sample at weeks 6 and 26. Hierarchical regressions indicated main effects for relapse prevention condition were significant at week 6 ($F(1,27)=11.04, p < .03$). Neither main or interaction effects were significant at week 26 or 52. There were too few nonabstainers ($n=13$) at week 3 to complete the hierarchical analysis. Number of cigarettes smoked and percent reduction for the entire sample and for continued smokers only are shown in Table 5.

Insert Table 5 About Here

Process Measures

Before outcome analyses were done, mood and withdrawal data symptom scales were analyzed to reduce the number of scores entered into the analyses.

Trait and State scores, the 6 POMS scales and the three withdrawal scales were entered into a principal component factor analysis with squared multiple correlations used as communality estimates (PA2; Nie, Hull, Jenkins, Steinbrenner and Bent, 1975). This analysis produced two factor based scales. The first was a mood scale which consisted of the sum of POMS tension, depression, anger and confusion scores and the State and Trait Anxiety Scores. The second was the sum of the three subscales of the Physical Symptoms Scale and the Fatigue scale of the POMS. Together, these two scales explained 96% of the item variance. The Mood scale explained 81%; the physical complaints scale, 15%.

Physical complaints, costs and benefits of smoking scores, and costs and benefits of change scores showed positive correlations at each assessment. Mood and behavior checklist scores showed few correlations with the other three scores or with each other. The former three scores were analyzed by multivariate analysis of variance. Univariate techniques were used for the latter two scores.

Coping Skills. Skills subjects were more likely to report use of specific relapse prevention strategies. At week 3, Kruskal Wallis ($H(1)=4.91$, $p<.04$ (skills mean=3.33, SD=1.40; discussion mean=2.76, SD=1.24, possible range 0-7)). At week 6, $H(1)=7.47$, $p<.02$ (skills mean=3.00, SD=1.43 discussion mean=2.62, SD=1.1). At week 52, $H(1)=1.21$, $p<.36$ (skills mean=2.30, SD=1.51; discussion mean=2.56, SD=4.6). In both conditions, abstinent subjects were more likely to use coping skills than smoking subjects. This occurred at all assessments but week 3. Differences were significant only at week 26, however (Kruskal Wallis $H(1)=3.74$, $p<.05$) {abstinent mean=2.38, SD=1.23, smoking mean=1.91, SD=1.26 }.

Costs and Benefits of Smoking, Change, and Physical Complaints. A two-way multivariate analysis of variance using residualized dependent variables was computed at each assessment. Independent variables were relapse prevention condition, abstinence status, and their interaction. The only significant difference was due to abstinence status at week 52 ($F(3,72)=4.54$, $p <.01$). This was due solely to significant differences in withdrawal score ($F(91,77)=10.45$, $p <.01$). Abstinent subjects had higher scores than smoking subjects. (Abstinent subjects mean=15.71; smoking subjects mean=10.67).

Mood. Abstinent subjects showed significantly less mood disturbance than smoking subjects at all assessments except week 52. Mood scores were

entered into a hierarchical linear regression (Cohen and Cohen, 1975) with pre-treatment score as the covariate and relapse prevention condition and abstinence status as the independent variables. For week 3, $F(1,116)=5.98$, $p<.01$, abstinent mean=105.23, smoking mean=151.15. For week 6, $F(1,111)=9.29$, $p<.01$, abstinent mean=96.52, smoking mean=138.00. For week 26, $F(1,107)=10.74$, $p<.01$, abstinent mean=87.33, smoking mean=111.68. At week 52, differences between abstinent and nonabstinent subjects were in the same direction but no longer significant. Differences between treatment conditions were not significant at any assessment.

DISCUSSION

The results indicate that relapse prevention skill training did prevent relapse among cigarette smokers. It was hypothesized differences between skill and discussion conditions would be found at week 6, 26, and 52. Differences in the hypothesized direction were found at all three assessments, in both number of cigarettes smoked and abstinence rates. The latter were evaluated by one-tailed tests, perhaps a controversial procedure. However, such tests seem the most reasonable criteria for these data, given the a priori hypotheses and the lack of power of the Chi-Square test. Most of the differences in the study reflect differences in abstinence rates between the condition. The skills condition produced greater short-term suppression of amount smoked in nonabstinent subjects, but these effects did not continue into long-term follow-ups.

Exploratory analyses indicated the skill training condition was especially effective for subjects who smoked less than 20 cigarettes per day at pre-treatment. This makes sense, since such subjects might be expected to have less pharmacologic dependence on nicotine than heavier smokers. Thus, a treatment which emphasizes "habit" factors should be more effective for them. However, it is unclear why the effect was so delayed, appearing only at 52 weeks.

The abstinence rates reported in this study should be interpreted cautiously

in comparison with earlier studies. Subjects who dropped out of treatment prior to the first relapse prevention session were not included in analyses of differences between relapse prevention conditions. This is sensible since they did not receive any of the treatment. However, the abstinence rates are not directly comparable to those reported in studies where the entire sample of subjects entering into treatment is included in the calculation of abstinence rates. On the other hand, proportion of drop-outs was small (8.8%). Also, our admission criteria were less restrictive than those used in many smoking treatment groups. We accepted subjects who were currently under psychiatric or psychological treatment, as long as they had not been hospitalized for psychiatric problems within one year. We did not rule out subjects with alcohol or drug abuse histories, or subjects who were prescribed major psychoactive medications. This inclusion of a broader span of smokers may result in lower abstinence rates. Still, while the overall abstinence rate for the skill training condition is good, it is not outstanding.

We suggest that our modest success was due to several factors. The model suggests that the success of the relapse prevention condition is due to matching a limited number of relapse prevention strategies to the problems of tobacco withdrawal. Previous programs have usually included a great many techniques, most of which had little to do with withdrawal symptoms or commonly experienced relapse situations. Also, in other programs, relapse prevention strategies were taught before smoking cessation treatment when motivation to learn about relapse, rather than cessation, was probably low. We interspersed relapse prevention sessions throughout treatment and the immediate follow-up period. Since subjects were instructed not to smoke outside the sessions after entering treatment, motivation to learn the techniques was probably high during the period when they were being taught. Other investigators did not include follow-up support

immediately after cessation, when subjects were most likely to relapse. We included two such sessions, both in the three weeks immediately following the termination of intensive treatment contact.

With respect to process variables, as predicted, performance of relapse prevention skills did differ between the two treatment conditions. Differences between conditions were significant early in treatment. This is sensible, given the items on the scale. The coping scale focussed on active coping strategies for situations which predominate immediately following cessation, such as anxiety, craving and social pressure. It did not measure strategies which may be related to long-term coping, such as prevention of weight gain, and strategies for sudden, unexpected emotional crises. Clinical experience indicates both of these may lead to relapse months or even years after cessation. This formulation does not fully explain the data, however. Abstinent subjects in both conditions were more likely to report skill use. It is even more puzzling that these differences were only significant at week 26, when differences in actual smoking behavior were not significant. The cognitive components of the model did not fare well. No significant differences due to perceived costs or benefits of smoking or of change attempts were found between conditions. Similarly, treatment conditions did not affect mood or physical complaints.

The outcome for mood and abstinence status replicates earlier data from a study of chronically ill smokers (Hall, Bachman, Henderson, Barstow, and Jones, 1983) which indicated that relapsed smokers experienced greater mood dysphoria after treatment than did abstinent subjects. In the present study, differences were strong and consistent. Many mechanisms could plausibly explain this finding. Smokers who cannot quit may have difficulty because they suffer from mood dysphoria. Also, persistent reduced levels of tobacco intake may lead to

greater discomfort than total abstinence (Shiffman, 1979). Finally, smokers may report more negative mood states in an attempt to justify their inability to quit.

The data for physical complaints at the 52 week assessment showed the opposite relationship. Had those differences occurred earlier, they would have supported the concept of a physical withdrawal syndrome. However, earlier comparisons did not even approach significance. The most parsimonious explanation for these findings is chance.

In summary, the present study provides support for the usefulness of a specific, targetable model in treatment design. Differences in outcome between the two treatment conditions were significant, and reported skill use differed between the two conditions. Cognitive variables and those presumed related to nicotine withdrawal showed no treatment dependent effect. Thus, the mechanisms by which these differences occur should be a topic for further research.

Differences between treatments were of moderate size and fluctuated from assessment to assessment. Further research should focus on increasing clinical efficacy. It is likely some components of the skill training program can be eliminated, and the focus of the program sharpened. For example, since the relaxation training component was quite brief, it may have had less of an effect than carbon monoxide feedback or skill training.

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Footnotes

¹We assume the quitting behavior of close relatives is too similar to allow such subjects to be treated independently. Therefore, all relatives (4 couples, one mother-daughter pair) were assigned to the same treatment condition. One member of the pair was randomly selected to serve as a subject. Data from the second pair member was discarded.

²Cotinine is a nicotine metabolite. It remains in the body for 24-48 hrs. after smoking and is thus thought to be a good indicator of day to day nicotine intake (Zeidenberg, Kanzler and Jaffe, 1975). Cotinines were analyzed by the method of Jacob, Wilson and Benowitz (1981).

³Significant other report agreed with self-reported abstinence for every subject for all assessments. The number of subjects exceeding the biochemical cut point for abstinence did not exceed 3 at any one assessment. With one exception all incongruities between self-report and biochemical measures were in the discussion condition. The carbon monoxide and thiocyanate values were chosen because they are within the nonsmoking range in an urban environment.

⁴Inclusion of drop-outs weakens, but does not eliminate differences between treatment conditions. For skills and behavioral conditions, differences were: week 3, 80 vs. 86%; week 6, 71 vs. 63%; week 26, 41 vs. 39%; week 52, 40 vs. 28%. Differences in abstinence rates between the two conditions at week 52 remain significant at $p < .05$. The treatment conditions by initial cigarette level interaction also remains significant. Differences observed at week 6 are no longer significant.

⁵We used self-reported rates for analyses on number of cigarettes even though self-reported abstinence did not coincide perfectly with biochemically verified abstinence. We did so because it was unclear how many cigarettes to assign subjects with discrepant self-reports, since their thiocyanate and carbon monoxide levels were typically lower than their baseline values. The

bias introduced by use of self-report in this instance is minimal and is conservative, since fewer skills than control subjects had discrepant self-reports, and few subjects in either group had self-reports which did not match the biochemical data.

Table 1
Cigarette Intake Characteristics at Pretreatment for
Subjects by Treatment Condition

		6 sec./ skills	30 sec./ skills	6 sec./ discussion	30 sec./ discussion
Cigarettes/Day	mean	31.72	27.79	26.82	31.53
	SD	20.23	13.07	13.90	14.41
Blood Cotinine	mean	241.67	268.2	334.75	251.26
	SD	137.35	127.84	174.98	126.87
Machine Deliver- ed Nicotine Dose	mean	25.10	23.73	26.43	21.10
	SD	25.17	13.73	18.20	14.73
Years Smoked	mean	18.28	18.14	14.91	18.16
	SD	8.21	6.85	6.14	7.50
For Entire Sample:					
Cigarettes/Day	mean=29.42				
	SD =29.42				
Blood Cotinine	mean=275.59				
	SD =275.59				
Machine Deliver- ed Nicotine Dose	mean=24.14				
	SD =18.22				
Years Smoked	mean=17.29				
	SD =17.29				

Table 2
Demographic Characteristics of Subjects
by Treatment Condition

		6 sec./ skills (n=29)	30 sec./ skills (n=28)	6 sec./ discussion (n=32)	30 sec./ discussion (n=34)
Sex	Male	12	10	14	15
	Female	17	18	18	19
SES*	1	4	1	5	2
	2	13	10	11	18
	3	9	14	11	9
	4	3	3	5	5
Marital Status:	Married	12	6	7	11
	Divorced or Separated	4	9	7	7
	Single	13	13	18	14
Education;	Graduate Training	11	8	7	7
	College Graduate	9	10	14	18
	Some College	7	9	9	8
	High School Diploma or less	2	0	2	1
Ethnicity:	Caucasian	27	25	31	31
	Other	2	3	1	3
Age:	Mean	38.17	36.25	35.28	34.15
	SD	9.01	7.09	9.89	8.37

*According to Hollingshead, A.R. Two Factor Index of Social Position. Yale University, Unpublished, 1965. (1 = highest; 7 = lowest).

Table 3
 Number (and Percent) Abstinent
 by Treatment Condition
 at each Assessment*

	6 sec./ skills (n=29)	30 sec./ skills (n=28)	6 sec./ discussion (n=32)	30 sec./ discussion (n=34)
week 3	26 (90)	25 (89)	30 (94)	30 (88)
week 6	22 (76)	24 (86)	22 (69)	22 (65)
week 26	16 (55)	14 (50)	15 (44)	12 (38)
week 52	15 (52)	11 (39)	11 (34)	9 (26)

*Number of dropouts for 6 sec./skills, 30 sec./skills, 6 sec./discussion and 30 sec./discussion were 4, 4, 3, and 1 respectively.

Table 4

Number of Cigarettes Smoked and Percent Reduction
for all Subjects at Each Assessment

		Skills (N=57)		Discussion (N=66)	
		Number of Cigarettes Smoked	Percent Reduction	Number of Cigarettes Smoked	Percent Reduction
Week 00	Mean	30.12	-	29.11	-
	SD	16.62	-	14.24	-
Week 03	Mean	.44	98.84	1.47	95.07
	SD	2.29	5.74	5.73	19.02
Week 06	Mean	1.37	96.61	5.35	84.51
	SD	3.87	8.93	10.96	30.26
Week 26	Mean	8.30	76.86	11.18	62.28
	SD	12.48	33.78	12.46	39.69
Week 52	Mean	13.21	64.36	13.24	52.97
	SD	18.52	40.95	13.82	42.38

Table 5

Number of Cigarettes Smoked and Percent Reduction for Continued
Smokers at Each Assessment

		Skills		Discussion	
		Number of Cigarettes Smoked	Percent Reduction	Number of Cigarettes Smoked	Percent Reduction
Week 03	Mean	4.17	88.96	13.86	53.53
	SD	6.34	15.43	12.47	40.83
	N	6		7	
Week 06	Mean	6.50	83.92	18.58	42.20
	SD	6.32	13.54	13.20	33.65
	N	12		19	
Week 26	Mean	18.19	49.21	19.95	32.72
	SD	12.72	33.22	10.02	28.28
	N	26		37	
Week 52	Mean	23.53	36.52	19.86	29.45
	SD	19.78	32.54	12.40	31.90
	N	32		44	